CHAPTER 5

RAW WATER PUMPING FACILITIES

5-1. Surface water sources.

a. Pump station arrangement. The location and arrangement of raw water pump stations will depend upon the requirements of the local situation and only general comments can be given. Raw water pump stations and intakes are often combined in a single structure, but this is not mandatory. The depth of the structure is a function of the type and arrangement of the pumps used. Horizontal centrifugal pumps are often employed and will give satisfactory performance and good operating economy. However, if the supply is from a variable stream and the pump suctions are to be under positive pressure under all operating conditions, a station of considerable depth probably will be required. Deep stations of the dry-pit type commonly used for horizontal centrifugal pumps should be compartmented so that rupture of pump discharge piping within the station will not flood all other pumps and motors. The depth may be reduced, with some loss in reliability, by installing the pumps at an elevation such that suction lift prevails under some operating conditions. Equipment for priming is a requirement when suction lift is employed. Use of vertical type wet-pit pumps, which requires less space in plan, permits a somewhat shallower station, and does not require priming, may prove an economical alternative. Among other pumping arrangements that could be used are: vertical-type pumps or end-or side-suction centrifugals, with their shafts in a vertical position, located on a submerged suction header. The latter permits location of the pump drive units at an elevation where they are protected from flooding and readily accessible.

b. Pump protection. Pumps, particularly those located on streams, must have protection against debris. In order to prevent or at least minimize screen clogging, the size of the screen openings should be consistent with the capacity of the pump to pass solids. The pump manufacturer can supply information on the largest sphere that the pump will pass. Plants with flows of 1 mgd or larger and obtaining their water from streams should use hydraulically cleaned traveling screens. For smaller installations or those not obtaining water from streams, a fixed bar screen or strainers can be used. For such arrangements, provisions must be made for cleaning. This can be accomplished by backflushing. In general, screening should be held to the minimum required for protection of the pumps. Excessively fine screens, strainers, or bar racks are sometimes subject to rapid clogging and will require frequent cleaning. Debris removed by mechanically cleaned screens must be collected and hauled to a landfill or other acceptable disposal site. Screenings may be stored temporarily at the station in dump carts from which they are discharged to a truck for transport to a disposal site.

c. Structural considerations. Substructures and superstructures will usually be of incombustible materials such as reinforced concrete, brick or other masonry. If these materials are not available, other materials will be evaluated. Structural design should include consideration of requirements for pump and motor servicing and removal for major repairs.

d. Ventilation. Where a gravity ventilation system is deemed inadequate to supply fresh air and remove fumes and heated air from the pump station, a forced ventilation system should be provided. The ventilation system should be capable of removing waste heat from the motors such that no more than a 10 degrees F. rise above ambient temperature of the air in the pump station is permitted. For occupied areas, the ventilation system will have a capacity of about six air changes per hour. If dust-producing chemicals are to be handled at the station, special dust exhaust systems will also be provided. Where chemicals are used in the pump station, precautions should be taken to insure that the exhaust from the ventilation system complies with air pollution prevention requirements.

e. Pumping equipment. In general, pumping equipment should be sized to conform to the rated capacity of the water treatment plant and will include a minimum of three electric motor-driven pumps. With the largest of the three pumps out of service, the remaining two pumps will be capable of supplying raw water at a rate equal to the rated capacity of the plant. To insure water service in the event of a major power outage, a sufficient number of pumps must be equipped for operation when normal electric power is not available. These pumps will be capable of supplying at least 50 percent of the rated capacity of the treatment plant, except where greater capacity is essential. Standby power for emergency operation can be provided by gas-turbine or diesel engine generators or by engines arranged to provide for pump operation by direct engine drives during the emergency.

5-2. Ground water sources. For most applications, either vertical line shaft turbine pumps or submersible turbine pumps will be used. For small-capacity or low-head applications, rotary or reciprocating (piston) pumps may be more appropriate. Factors influencing the selection of pumping equipment include well size, maximum pumping rate, range in pumping rate, maximum total head requirements, range in total head requirements, and type of power available. If all pumps use electric power as the primary energy source, a sufficient number of the pumps must be equipped for emergency operation when normal electric power is not available. Emergency power can be provided by gas-turbine or diesel engine generators or by engines arranged to provide for pump operation by direct engine drives during the emergency. These standby-powered pumps will be capable of supplying at least 50 percent of the required daily demand, except where greater capacity is essential.

5-3. Electric power. If dual electric power feeders, breakers, transformers, and switchgear can be provided, they will increase the station's reliability but may add appreciably to its cost. If a high degree of reliability is deemed necessary, the station should be served by independent transmission lines that are connected to independent power sources or have automatic switchover to direct drive engines.

5-4. Control of pumping facilities. Supervisory or remote control of electric motor-driven pumping units will be provided if such control will substantially reduce operator time at the facilities.